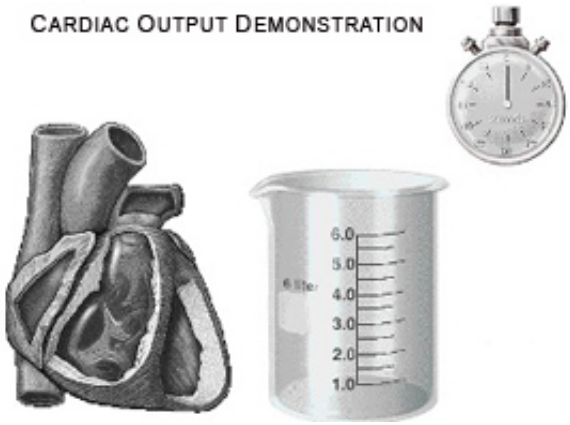
Assignment 9: The Heart, part 2: Chapter 18

Due: 11:59pm on Monday, March 25, 2013

Note: To understand how points are awarded, read your instructor's Grading Policy.

IP: Regulation of Cardiac Output

Click on the link or the image below to explore Regulation of Cardiac Output in Interactive Physiology (IP), then answer the questions to the right.
IP: Regulation of Cardiac Output



Part A

Which of the following would increase cardiac output to the greatest extent?

Hint 1.

Think about the equation for cardiac output.

ANSWER:

- increased heart rate and increased stroke volume
- increased heart rate and decreased stroke volume
- decreased heart rate and increased stroke volume
- decreased heart rate and decreased stroke volume

Correct

Yes, cardiac output = heart rate x stroke volume.

Part B

Which of the following would increase heart rate?

Hint 1.

Consider the two divisions of the autonomic nervous system and the neurotransmitters used in each.

ANSWER:

- epinephrine and norepinephrine
- increased activity of the parasympathetic nervous system
- acetylcholine
- decreased activity of the sympathetic nervous system

Correct

Yes, secreted by the adrenal medulla as a result of sympathetic stimulation, these hormones act as part of the sympathetic response, increasing heart rate.

Part C

How would an increase in the sympathetic nervous system increase stroke volume?

Hint 1.

Think of the factors that can increase stroke volume. Which factors would the sympathetic nervous system alter?

ANSWER:

- increased end systolic volume
- increased end diastolic volume
- increased contractility
- decreased end diastolic volume

Correct

Yes, an increase in sympathetic nervous system activity would increase contractility (by increasing available calcium), thus increasing stroke volume. Contractility causes an increase in stroke volume by decreasing end systolic volume; it does not change end diastolic volume.

Part D

By what mechanism would an increase in venous return increase stroke volume?

Hint 1.

What would happen to cardiac filling if more blood were returned to the ventricle?

ANSWER:

- decreased end diastolic volume
- increased end diastolic volume
- increased end systolic volume
- increased contractility

Correct

Yes, an increase in venous return increases the end diastolic volume. The fibers are stretched more, resulting in an increase in the force of contraction (preload, or the Frank-Starling Mechanism).

Part E

How would a decrease in blood volume affect both stroke volume and cardiac output?

Hint 1.

If blood volume decreased, what determinant of stroke volume would be altered? What would that do to the stroke volume and cardiac output? Which branch of the autonomic nervous system would be activated to compensate for this change?

ANSWER:

- increased stroke volume and increased cardiac output
- decreased stroke volume and decreased cardiac output
- decreased stroke volume and no change in cardiac output
- no change in stroke volume and decreased cardiac output

Correct

Yes, a decreased blood volume would decrease the end diastolic volume, thus lowering the stroke volume. Although this would initially lead to a decrease in the cardiac output, heart rate would increase because of increased activity of the sympathetic nervous system in an effort to maintain cardiac output.

Video Tutor: Cardiac Cycle (part 1: volume changes)

Watch the Video Tutor on the Cardiac Cycle (part 1: volume changes), then answer the questions below.

Part A

What is the main function of heart valves?

Hint 1. The role of heart valves

ANSWER:

- to pump blood through the heart
- to separate the left and right atria
- to prevent backward flow of blood
- to separate the atria and ventricles

Correct

Heart valves are one-way valves that prevent blood from flowing backward. For example, the AV valves only allow blood to flow from the atria to the ventricles. And the semilunar valves only allow blood to flow from the ventricles to the aorta and pulmonary trunk. When valves do not completely close, blood flows backward through the heart, creating an abnormal "sloshing" sound known as a heart murmur.

Part B

When the atria contract, which of the following is true?

Hint 1. Events during atrial contraction

ANSWER:

- The semilunar valves are open.
- The atria are in diastole.
- The AV valves are closed.
- The ventricles are in diastole.

Correct

Atrial contraction fills each of the ventricles to their maximum capacity−the end diastolic volume (EDV). This occurs towards the end of ventricular diastole while the ventricles are still relaxed.

Part C

Which of the following is equivalent to the ventricular volume during isovolumetric contraction?

Hint 1. Blood volume and isovolumetric contraction

ANSWER:

- the minimum ventricular volume (MVV)
- the end systolic volume (ESV)
- The end diastolic volume (EDV)
- the stroke volume (SV)

Correct

Isovolumetric contraction occurs at the beginning of ventricular systole when the ventricular volume is at its maximum value−the end diastolic volume (EDV). Because no volume changes occur during isovolumetric contraction, ventricular volume remains at this value throughout the phase.

Part D

Which of the following is true during ventricular systole?

Hint 1. Events during ventricular systole

ANSWER:

- The ventricles are relaxed.
- The AV valves are closed.
- The ventricles are empty.
- The atria are in systole.

Correct

At the beginning of ventricular systole, the one-way AV valves are forced shut. The AV valves remain shut throughout ventricular systole. This prevents blood from flowing back into the atria when the ventricles contract.

Part E

During the ventricular ejection phase of the cardiac cycle, which of the following is true?

Hint 1. Events during ventricular ejection

ANSWER:

- The semilunar valves are open.
- The ventricles are in diastole.
- The AV valves are open.
- The atria are in systole.

Correct

During ventricular ejection, blood flows from the ventricles into the arteries. To do so, the blood must pass through the semilunar valves, which must be open during this phase. Narrowing of the left semilunar valve reduces blood flow out of the heart, a disease condition known as aortic stenosis.

Part F

Most of the decrease in ventricular volume takes place during which phase of the cardiac cycle?

Hint 1. When ventricular volume falls

ANSWER:

- ventricular ejection
- atrial contraction
- ventricular filling
- isovolumetric relaxation

Correct

As the ventricles contract, blood is forced through the semilunar valves and out into the arteries, resulting in a reduction in ventricular blood volume. At the end of this phase, ventricular volume is at a minimum−the "end-systolic volume" (ESV).

Part G

Which of the following is equivalent to the ventricular volume during isovolumetric relaxation?

Hint 1. Blood volume and isovolumetric relaxation

ANSWER:

- maximum ventricular volume (MVV)
- end systolic volume (ESV)
- end diastolic volume (EDV)
- stroke volume (SV)

Correct

Isovolumetric relaxation occurs at the beginning of ventricular diastole when the ventricular volume is at its minimum value−the end systolic volume (ESV). Because no volume changes occur during isovolumetric relaxation, ventricular volume remains at this value throughout the phase.

Part H

Most of the increase in left ventricular volume takes place during what phase of the cardiac cycle?

Hint 1. When ventricular volume increases

ANSWER:

- isovolumetric relaxation
- ventricular ejection
- ventricular filling
- atrial contraction

Correct

During ventricular filling the AV valves remain open, which allows blood to flow from the atria into the ventricles. The passive flow of blood during this phase (before atrial contraction) accounts for roughly 80 percent of the increase in ventricular volume.

Video Tutor: Cardiac Cycle (part 2: pressure changes)

Watch the Video Tutor on the Cardiac Cycle (part 2: pressure changes), then answer the questions below.

Part A

In what direction does blood flow through the heart?

Hint 1. Blood flow through the heart

ANSWER:

- from a region of high pressure to a region of low pressure
- from a region of high oxygen content to a region of low oxygen content
- from ventricles to atria
- from a region of high volume to a region of low volume

Correct

Blood moves through the heart from atria to ventricles and out large arteries, always from areas of high pressure to areas of lower pressure through one-way valves.

Part B

Atrial pressure is greater than ventricular pressure during which phase of the cardiac cycle?

Hint 1. The cardiac cycle and pressure gradients

ANSWER:

- isovolumetric contraction
- ventricular ejection
- atrial contraction
- isovolumetric relaxation

Correct

Blood always flows from high to low pressure. During atrial contraction, blood flows from atria (high pressure) to ventricles (low pressure). Similarly, this same pressure gradient exists during ventricular filling.

Part C

At what point during the cardiac cycle does the AV valve close?

Hint 1. The function of the AV valve, and how it operates

ANSWER:

- when the semilunar valve opens
- when ventricular pressure becomes greater than atrial pressure
- when aortic pressure becomes greater than ventricular pressure
- when ventricular pressure becomes greater than aortic pressure

Correct

When ventricular pressure rises above atrial pressure, the AV valve closes. This prevents blood from flowing backward through the heart.

Part D

At what point in the cardiac cycle does the semilunar valve open?

Hint 1. The function of the semilunar valve, and how it operates

ANSWER:

- when atrial pressure becomes greater than ventricular pressure
- when ventricular pressure becomes greater than atrial pressure
- when ventricular pressure becomes greater than aortic pressure
- when the AV valve closes

Correct

When pressure in the ventricle exceeds pressure in the aorta, the semilunar valve opens. This allows blood to be ejected from the ventricle.

Part E

Ventricular pressure is greater than aortic pressure during which phase of the cardiac cycle?

Hint 1. When ventricular pressure is greater than aortic pressure

ANSWER:

- isovolumetric relaxation
- ventricular filling
- ventricular ejection
- isovolumetric contraction

Correct

While pressure in the ventricle is greater than pressure in the aorta, the semilunar valve remains open. This allows blood to be ejected from the ventricle.

Part F

At what point in the cardiac cycle does the semilunar valve close?

Hint 1. When the semilunar valve shuts

ANSWER:

- when atrial pressure becomes greater than ventricular pressure
- when pressure in the ventricle becomes less than aortic pressure
- when ventricular pressure becomes greater than aortic pressure
- when ventricular pressure becomes greater than atrial pressure

Correct

When pressure in the ventricle drops below aortic pressure, the semilunar valve shuts. This prevents blood from flowing backward through the heart.

Part G

Isovolumetric relaxation is characterized by which of the following?

Hint 1. Events associated with isovolumetric relaxation

ANSWER:

- Pressure in the ventricle exceeds pressure in the aorta.
- Blood flows backward through the heart from high to low pressure.
- The semilunar and AV valves are closed.
- Pressure in the atrium exceeds pressure in the ventricle.

Correct

During isovolumetric relaxation, all valves into and out of the ventricles remain closed. This prevents blood from flowing backward through the heart.

Part H

At what point in the cardiac cycle does the AV valve open?

Hint 1. The function of the AV valve, and how it operates

ANSWER:

- when aortic pressure becomes greater than ventricular pressure
- when ventricular pressure becomes greater than aortic pressure
- when the semilunar valve closes
- when atrial pressure becomes greater than ventricular pressure

Correct

Blood flows through the heart in one direction (atria-ventricles-large arteries) and from high to low pressure. When pressure in the atrium becomes greater than ventricular pressure, the AV valve opens; and blood flows from the atrium into the ventricle.

IP: Cardiac Cycle

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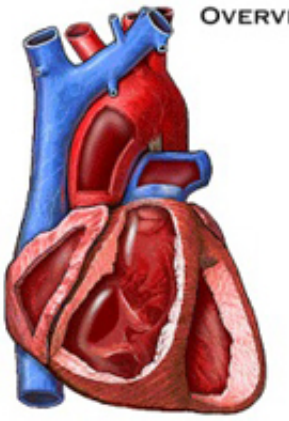
IP: Cardiac Cycle



Part A

Isovolumetric relaxation and ventricular filling (two phases of the cardiac cycle) take place during _____.

Hint 1.

Both take place during the phase when blood pressure is lowest in the aorta.

ANSWER:

- ventricular systole
- ventricular diastole

Correct

Yes, both occur during ventricular diastole when the ventricles are not actively contracting and ejecting blood.

Part B

Which of the following is correct about the filling of the ventricles?

Hint 1.

Think of the size of the atria and ventricles.

ANSWER:

- The majority of ventricular filling is caused by contraction of the atria.
- Most blood flows passively into the ventricles through open AV valves.

Correct

Yes, most of the ventricular filling is passive; atrial contraction adds just a little more blood.

Part C

Describe the pressures in the atria and ventricles that would cause the opening of the AV valves.

Hint 1.

Blood moves from a higher pressure to a lower pressure.

ANSWER:

- (•) Pressure in the atria would be greater than the pressure in the ventricles.
- ( ) Pressure in the ventricles would be greater than in the atria.
- ( ) Pressures in the atria and ventricles would be equal.

Correct

Yes, higher pressure in the atria than in the ventricles forces the AV valves to open and blood moves into the ventricles.

Part D

What causes the aortic semilunar valve to close?

Hint 1.

Remember that blood flows from a higher pressure to a lower pressure.

ANSWER:

- (•) greater pressure in the aorta than in the left ventricle
- ( ) higher ventricular pressure than aortic pressure
- ( ) equal ventricular and aortic pressures

Correct

Yes, backflow of blood in the aorta (towards the left ventricle) closes the aortic semilunar valve.

Part E

Put the phases of the cardiac cycle in the correct order, starting after ventricular filling.

Hint 1.

If the ventricle is full, what would happen next?

ANSWER:

- ventricular ejection, ventricular relaxation, isovolumetric contraction
- ventricular ejection, isovolumetric contraction, isovolumetric relaxation
- isovolumetric contraction, ventricular ejection, isovolumetric relaxation
- isovolumetric relaxation, ventricular ejection, isovolumetric contraction

Correct

Yes, the ventricles must contract and eject blood before they relax and fill again.

Part F

Increased pressure in the ventricles would close what valve(s)?

Hint 1.

Remember, blood moves from high pressure to low pressure.

ANSWER:

- AV valves only
- semilunar valves only
- both semilunar and AV valves

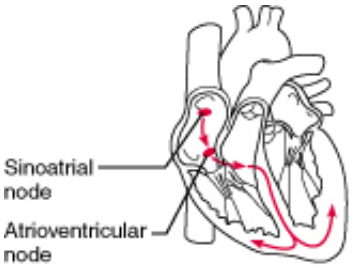
Correct

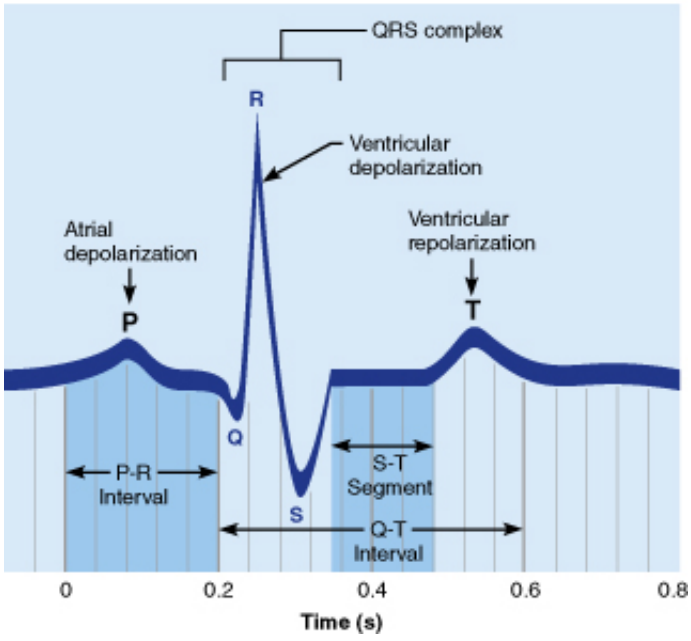
Yes, increased pressure in the ventricles would close the AV valves.

Art Question Chapter 18 Question 19

Part A

Which portion of the electrocardiogram represents the depolarization wave received from the sinoatrial (SA) node through the atria?





ANSWER:

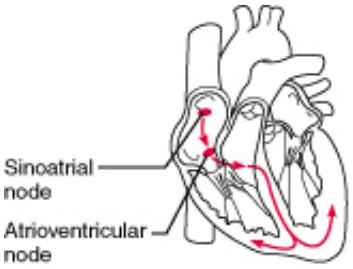
- S-T segment
- P wave
- QRS complex
- T wave

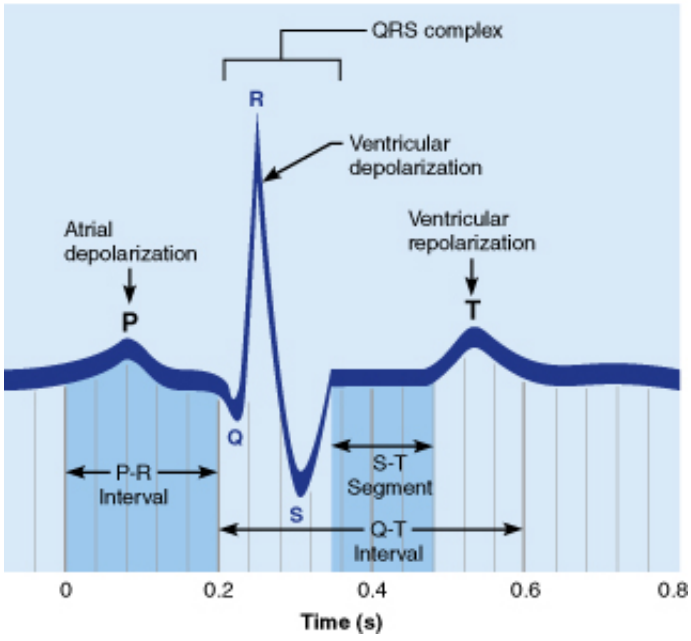
Correct

Art Question Chapter 18 Question 21

Part A

During which portion of the electrocardiogram do the atria contract?





ANSWER:

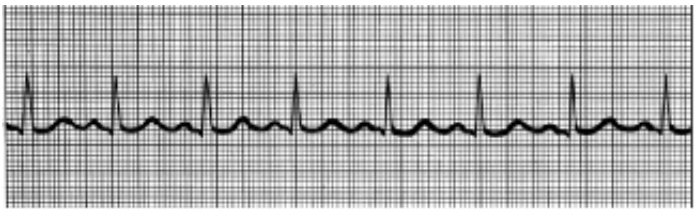
- (•) P-R interval
- ( ) P wave
- ( ) Q-T interval
- ( ) S-T segment

Correct

Art Question Chapter 18 Question 22

Part A

Determine which of the following electrocardiogram (ECG) tracings is missing P waves. Select from letters A-D.



A

B

C

D

ANSWER:

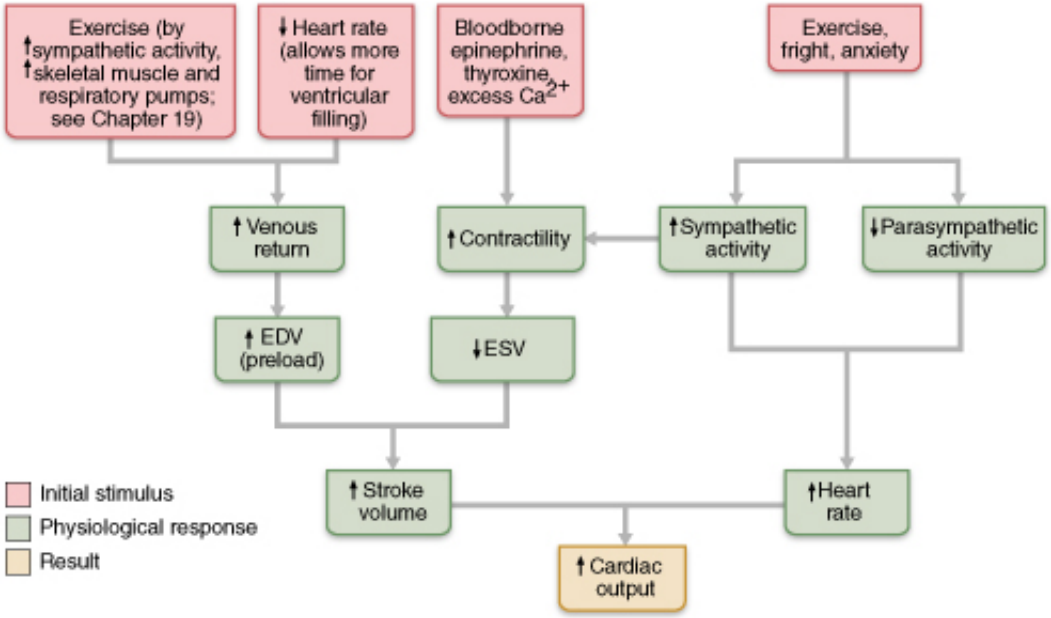
- A
- B
- C
- D

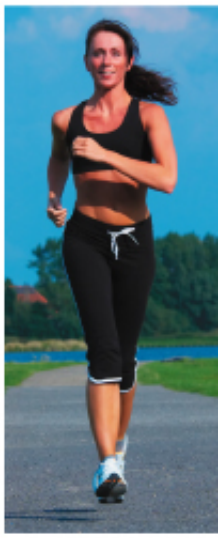
Correct

Art Question Chapter 18 Question 28

Part A

Which of the following would cause a decrease in the contractility of the heart?





ANSWER:

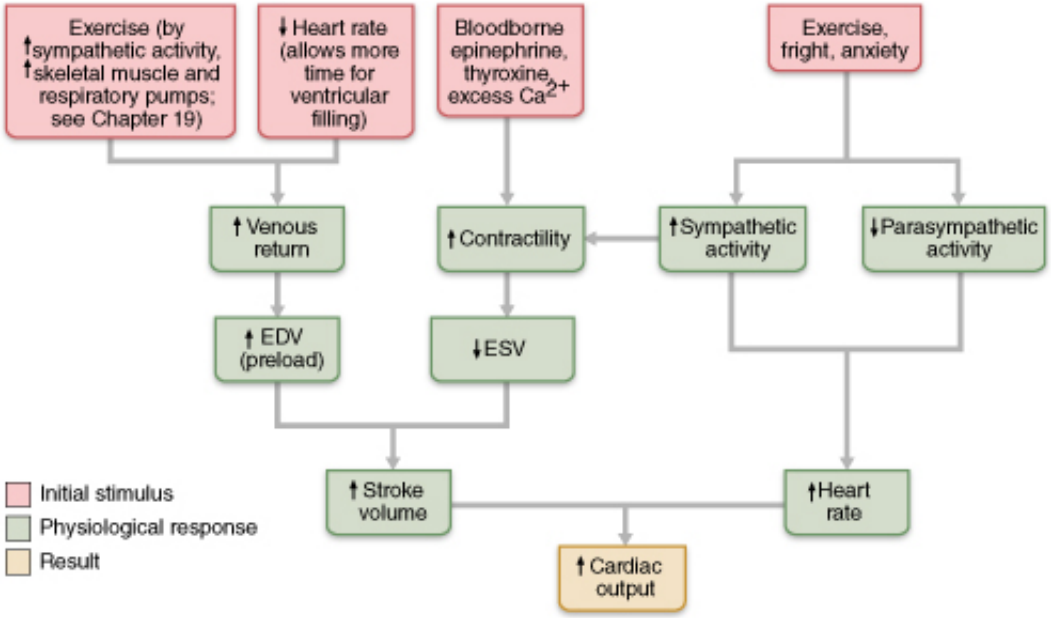
- thyroxine
- epinephrine
- increasing extracellular potassium levels
- increasing extracellular calcium levels

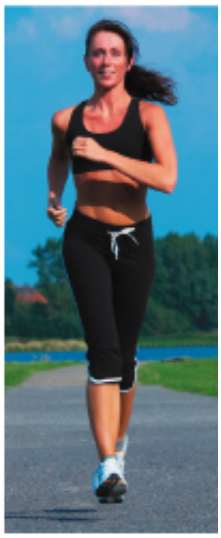
Correct

Art Question Chapter 18 Question 29

Part A

Calculate the stroke volume if the end diastolic volume (EDV) is 135 mL/beat and the end systolic volume (ESV) is 60 mL/beat.





ANSWER:

- 120 mL/beat
- 60 mL/beat
- 75 mL/beat
- 205 mL/beat

Correct

Chapter 18 Chapter Test Question 11

Part A

The QRS complex on an electrocardiogram represents _____.

ANSWER:

- ventricular depolarization
- atrial depolarization
- atrial repolarization
- ventricular repolarization

Correct

The QRS complex shows ventricular depolarization.

Chapter 18 Chapter Test Question 15

Part A

Which of the following would *increase* heart rate?

ANSWER:

- parasympathetic stimulation
- low metabolic rate
- epinephrine
- cold temperature

Correct

Sympathetic stimulation (i.e., exercise) can lead to the release of epinephrine and norepinephrine, both of which increase heart rate.

Chapter 18 Reading Quiz Question 5

Part A

Which of the following structures sets the pace of heart contraction?

ANSWER:

- AV node
- SA node
- atrioventricular bundle
- bundle branches

Correct

The SA node sets the pace or rate of heart contraction.

Chapter 18 Reading Quiz Question 6

Part A

What does the T wave of the electrocardiogram (ECG) represent?

ANSWER:

- atrial depolarizaton
- ventricular depolarization
- ventricular repolarization
- atrial repolarization

Correct

The T wave of the ECG represents ventricular repolarization as the heart rests and prepares to contract again.

Chapter 18 Reading Quiz Question 8

Part A

What is afterload?

ANSWER:

- degree of stretch of the heart muscle
- cardiac reserve
- back pressure exerted by arterial blood
- contractility of cardiac muscle

Correct

Afterload refers to the back pressure exerted by arterial blood, or the pressure that must be overcome for the ventricles to eject blood.

Chapter 18 Clinical Application Question 7

Part A

A 55-year-old male was admitted to the hospital with heart failure. He complains of increasing shortness of breath on exertion, and of needing to sleep on three pillows at night. On physical assessment, the nurse determines that his ankles and feet are very swollen. Which of these symptoms either reflect left-sided and/or right-sided heart failure?

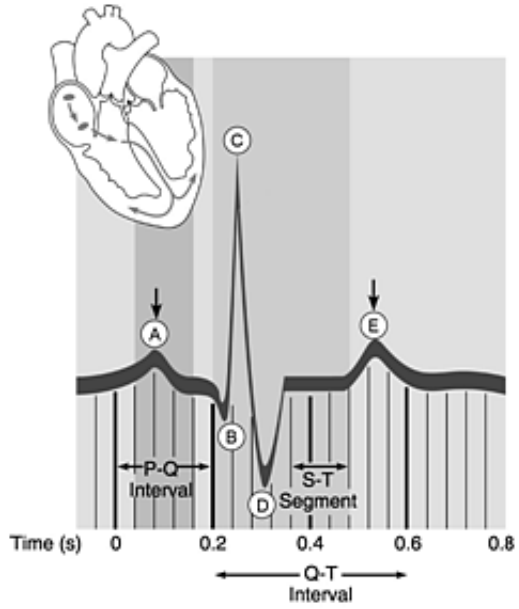
ANSWER:

- Right side failure results in shortness of breath and edema in the extremities.
- Left side failure results in edema in the extremities. Right side failure results in shortness of breath.
- Left side failure results in shortness of breath. Right side failure results in edema in the extremities.
- Left side failure results in shortness of breath and edema in the extremities.

Correct

Chapter 18 Matching Question 9

Part A



Point that represents the "dup" sound made by the heart.

ANSWER:

- A
- B
- C
- D
- E

Correct

Chapter 18 Multiple Choice Question 5

Part A

Damage to the _____ is referred to as heart block.

ANSWER:

- AV bundle
- AV valves
- AV node
- SA node

Correct

Chapter 18 Multiple Choice Question 13

Part A

Which of the following factors does *not* influence heart rate?

ANSWER:

- gender
- body temperature
- age
- skin color

Correct

Chapter 18 Multiple Choice Question 19

Part A

A foramen ovale _____.

ANSWER:

- is a shallow depression in the interventricular septum
- is a connection between the pulmonary trunk and the aorta in the fetus
- is a condition in which the heart valves do not completely close
- connects the two atria in the fetal heart

Correct

Chapter 18 Multiple Choice Question 21

Part A

Which of these vessels receives blood during ventricular systole?

ANSWER:

- both the aorta and pulmonary trunk
- pulmonary veins only
- pulmonary arteries only
- aorta only

Correct

Chapter 18 Multiple Choice Question 34

Part A

Isovolumetric contraction _____.

ANSWER:

- occurs while the AV valves are open
- occurs immediately after the aortic and pulmonary valves close
- refers to the short period during ventricular systole when the ventricles are completely closed chambers
- occurs only in people with heart valve defects

Correct

Chapter 18 True/False Question 10

Part A

The "lub" sounds of the heart are valuable in diagnosis because they provide information about the function of the heart's pulmonary and aortic valves.

ANSWER:

- True
- False

Correct

Chapter 18 True/False Question 14

Part A

As pressure in the aorta rises due to atherosclerosis, more ventricular pressure is required to open the aortic valve.

ANSWER:

- True
- False

Correct

Score Summary:

Your score on this assignment is 95.2%.
You received 21.91 out of a possible total of 23 points.